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None

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(54) Electromechanical locking device

(57) An electromechanical locking device comprises one or more bolts 10 coupled to a pivoted actuating member 15. A first electromagnet 30 operates a blocking pin 25 to lock the bolt(s) extended or retracted and second electromagnets 50 can act on permanent magnets 20 to effect bolt extension or retraction. An electronic control unit coordinates the action of the electromagnets to move and block/unblock the bolt(s).

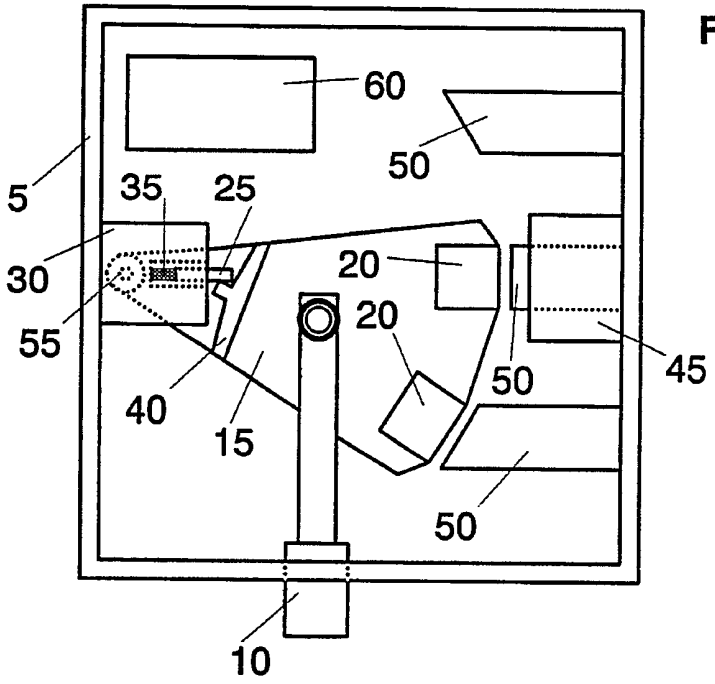

Figure 1

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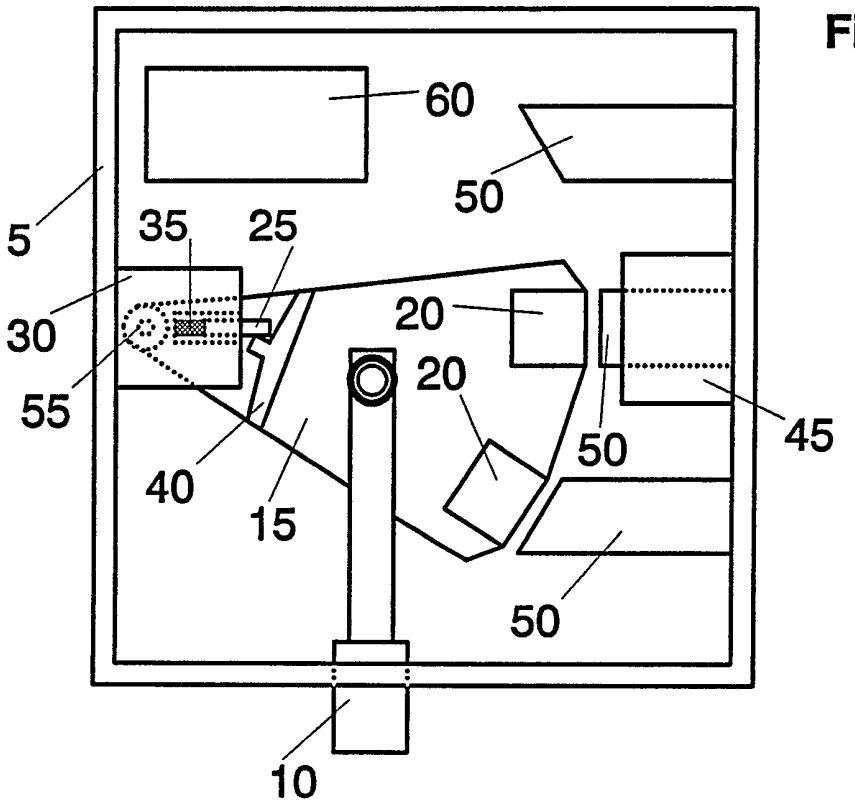


Figure 1

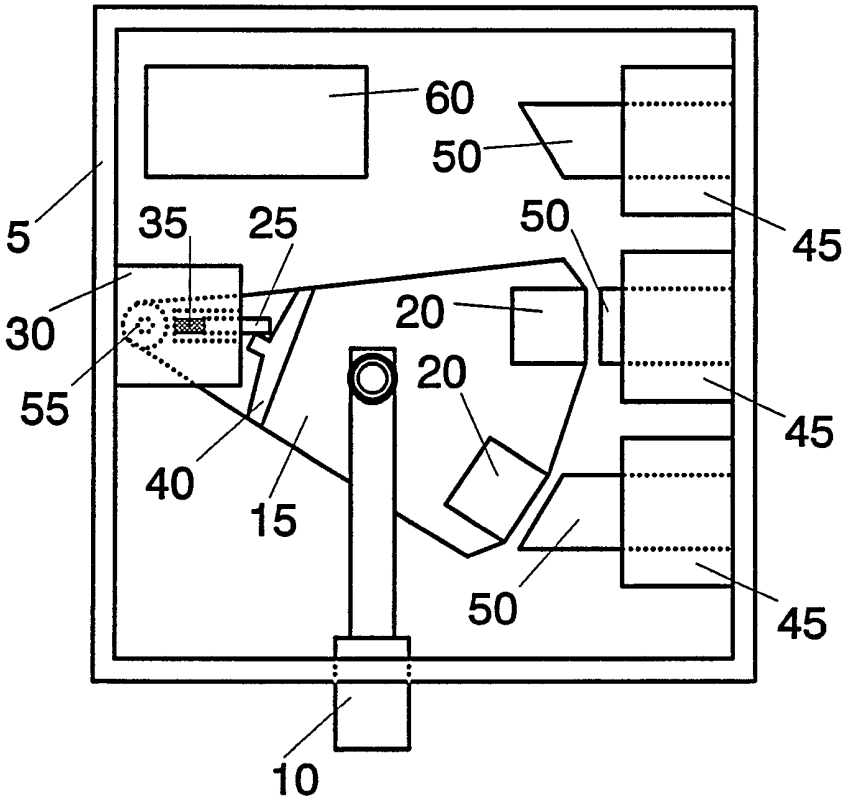


Figure 2

Figure 3

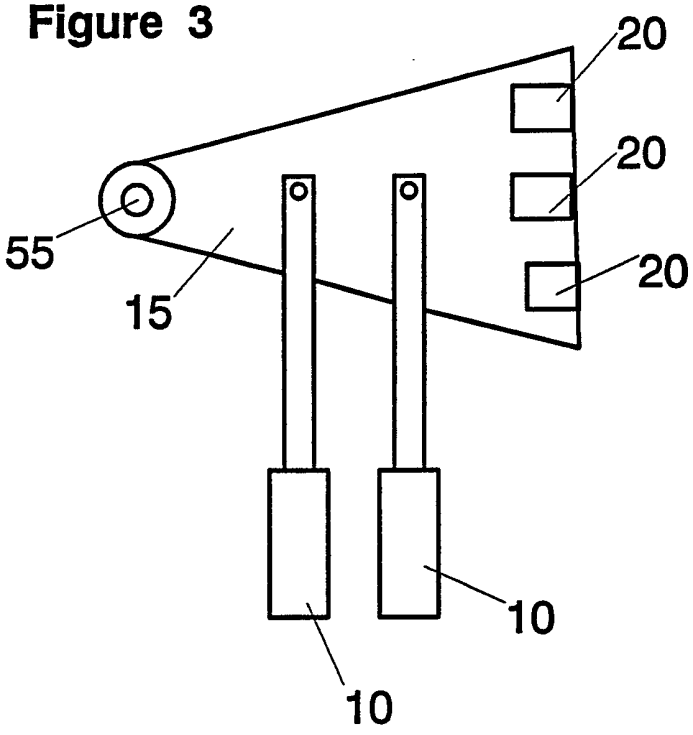


Figure 4

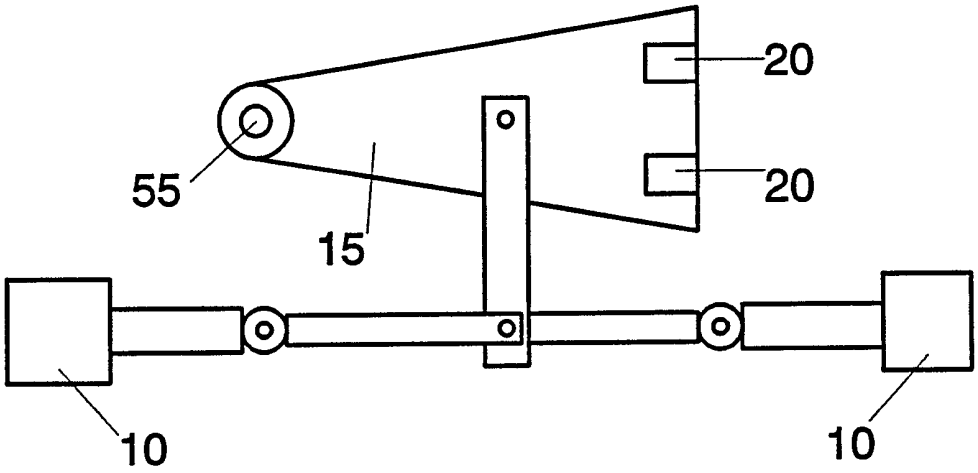


Figure 5

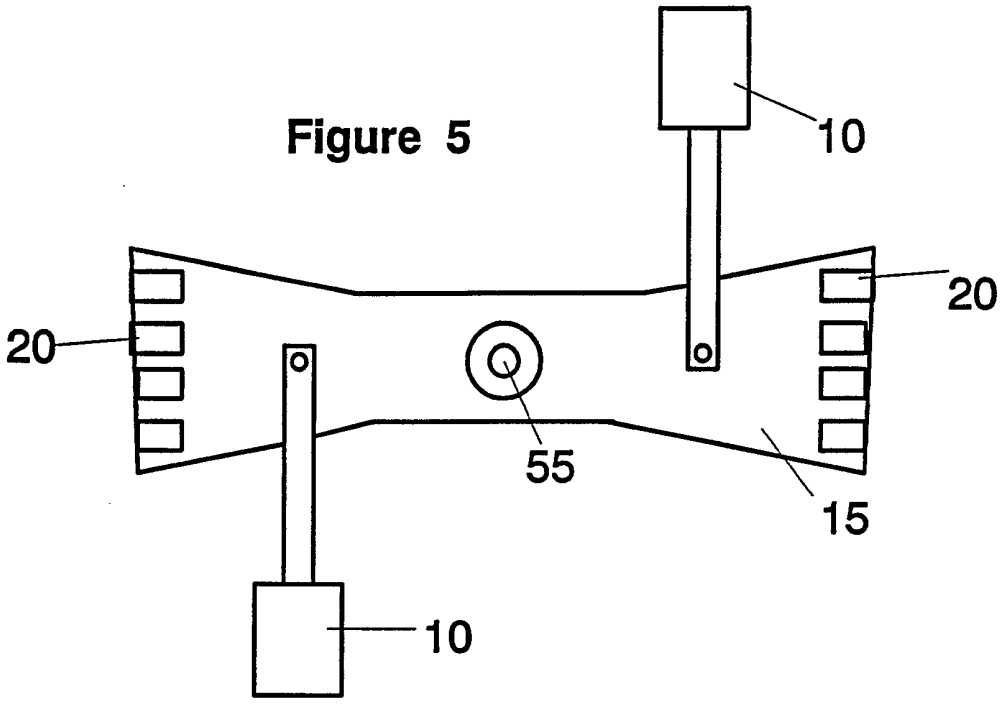
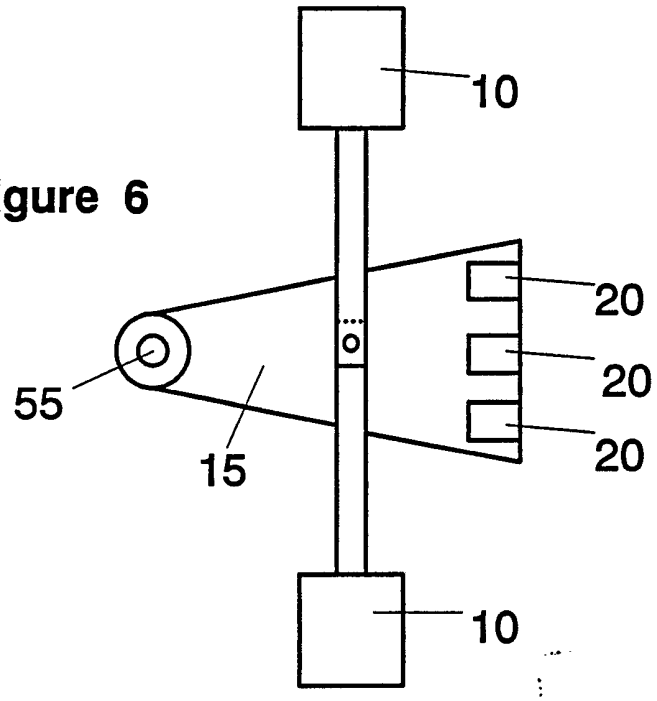


Figure 6



TITLE
Electromechanical Security Device

TECHNICAL FIELD
This invention relates to an electromechanical locking device controlled by electronic/electrical means.

BACKGROUND
Electromechanical locking devices are used to secure dwellings, banks, prisons, security deposit safes, machines, automobiles, and many more applications.
In brief, such locks comprise one or more electromagnets that serve to actuate one or more mechanical constructions including a bolt/latch that moves from a locking position into an unlocking one or vice versa. The purpose of such devices is to secure the safety of premises and constructions, and to allow a controlled access to, or use of any such applications.
Some examples of such devices are those described in the following patents:
PCT/GB-92/01766, GB-2231367(B), GB-223550(B), US-5216909, GB-2139689, US-4686912, GB2024922, US-4982585, EURO-0293137, US-4685709, GB-2055951, and GB-2166484.

OBJECTS OF THE INVENTION
This invention aims at satisfing a chronic demand for an effective security system in the face of ever-increasing number of motor vehicle thefts, unauthorised driving away of motor vehicles; theft from premises and other fixed or mobile constructions.

This invention takes into consideration the constraint of space available for installing such locking devices and the problems of tampering, manipulation, and reliability and proposes some new remedies

It is a principal object of this invention to provide an electromechanical locking device the activation of which can be coordinated with a vast multiplicity of other applications. Such coordination is effected by means of security electronic circuitry.

ESSENTIAL TECHNICAL FEATURES

According to this invention there is provided an electromechanical locking device comprising one or more bolts coupled freely onto a pivoted revolving arm incorporating two or more pieces of permanent magnets; means for effecting the blocking and unblocking of the bolt/bolts both in the retracted unlocking position and the protruding locking one; a first electromagnet that serves, when energized, to effect the unblocking of the bolt/bolts; a second electromagnet with one or more solenoidal coils wrapped over one or more ferromagnetic bars, the energizing of the said second electromagnet induces a certain direction magnetic field the interaction of which with that of the permanent magnets causes the revolving arm to rotate around its pivot; an electronic electrical control unit forming an integral part of the device effects, when successfully commanded, the coordinated energizing of the first and second electromagnets together with the concomitant reversal of polarity of the electric current energizing the second electromagnet and thus causes the bolt/bolts to move either from a retracted unlocking position into a protruding locking one and be blocked therein or vice versa.

The commanding of the said control unit can be effected by one or more of the following means: a coded remote control circuitry, a safety key electrical switch, a keypad, biometric means of control, coded electronic key, or any other similar means.

The reversal of polarity of the impulse electric current energizing the second electromagnet effects a reversal in the direction of the resultant magnetic field and consequently a reversal in the direction of movement of the revolving arm.

An electromechanical device according to this invention wherein the coordinated movement of the bolt/bolts between the locking and the unlocking positions and the consequent blocking of the bolt/bolts therein can not be effected without the coordinated energizing of the said first and second electromagnets.
The reversal of polarity and the passing of a certain intensity impulse electric current from a power supply to the said first and second electromagnets can only be effected by an electronic electrical control unit forming an integral part of the present invention.

Both the reversal of polarity of the impulse electric current energising the second electromagnet and the passing of an impulse electric current from a power supply to the said first and second electromagnets are effected by an electronic electrical control unit 60 placed inside the casing of the device.
Commanding the said control unit can be effected by one or more of the following means: coded remote control circuitry, safety key electrical switch, biometric means of control, keypad, or coded electronic key.

Without bypassing the said control unit or having the right access code or means of command it is impossible to effect the energizing of the first and second electromagnets.

To bypass the control unit it is necessary to gain access into the device, however, such access is denied when the device is in the locking position.

Another examples of the embodiment of the invention is an electromechanical locking device substantially as herein described and wherein the solenoidal coils of the second electromagnet are wrapped over more than one ferromagnetic bar as shown in Figure 2;

or wherein the revolving arm has incorporate into it more than two pieces of permanent magnets, and coupled freely onto it more than one bolt as shown in Figure 3;

or wherein the said bolts are linked together in a certain manner whereby the bolt/bolts simultaneously protrude out of the device and retract into it as shown in Figure 4;

or wherein the revolving arm is diametrically symetrical and incorporates more than two pieces of permanent magnets and has more than one bolt coupled freely onto it as shown in Figure 5;

or as shown in Figure 5 and Figure 6 of the present invention wherein one bolt protrudes out of the device while at the same instant another one retracts into it.

PREFERRED EMBODIMENT

The preferred embodiment of this invention can now be explained by way of example with reference to the following drawings.

Figure 1 shows in perspective the various elements of the device.
Figure 2 shows in perspective the various elements of the device with one variation concerning the number of coils of the second electromagnet.
Figure 3 shows the revolving arm with a variation on the number of bolts and pieces of permanent magnets.
Figure 4 shows the revolving arm with a variation on the fixing of the bolts.
Figure 5 shows another possible variation of the revolving arm, bolts and pieces of permanent magnets.
Figure 6 shows the revolving arm with three permanent magnets and another variation on the fixing of the bolts.

Referring to Figure 1 a preferred embodiment of this invention is an electromechanical security device 5 wherein the energizing of a first electromagnet 30 by a certain duration impulse electric current induces a certain intensity magnetic field the force of which impels a ferromagnetic pin 25 to retract away from a blocking bar 40 incorporated into a revolving arm 15 and thus freeing the movement of the said revolving arm. The revolving arm can now rotate around a pivot 55 under the resultant magnetic force caused by the interaction of the magnetic field of two pieces of permanent magnets 20 incorporated into the said revolving arm and of that induced by a second electromagnet 45 the solenoidal coil of which is wrapped over the middle one of three ferromagnetic bars 50. The coordinated energizing of the said first and second electromagnets together with the simultaneous reversal of the electric current energizing the second electromagnet causes a bolt 10 coupled freely onto the revolving arm to move from a retracted unlocking position into a protruding locking one or vice versa.
With the breaking of the impulse electric current energizing the first electromagnet the said pin thrusts back against the said blocking bar under the force of a spring 35 and thus effects the blocking of the revolving arm and consequently the said bolt in either the locking or the unlocking position as the case may be.

The bolt/bolts may take varying shapes and constructions other than those described in the drawings herein.

The shape of the revolving arm and the number of permanent magnets incorporated into it, the shape of the second electromagnet and the number of ferromagnetic bars over which the solenoidal coils are wound can vary according to the size, speed and strength required from the device.

The said second electromagnet may be split into two or more segments or may be extended to form a semicircular shape.

The means for blocking the movement of the bolt/bolts may take other forms (other than thoses described herein), and the first electromagnet may be placed anywhere within the casing of the device whereby the blocking of the bolt/bolts may be effected directly by acting on the bolt/bolts or indirectly by acting on the revolving arm. The blocking of the bolt/bolts may require more than one such first electromagnet.

The examples of varying embodiments of the present invention cited herein are only some of a wider scope of variations.

CLAIMS

1 An electromechanical locking device comprising one or more bolts coupled freely onto a pivoted revolving arm incorporating two or more pieces of permanent magnets; means for effecting the blocking and unblocking of the bolt/bolts both in the retracted unlocking position and the protruding locking one; a first electromagnet that serves, when energized, to effect the unblocking of the bolt/bolts; a second electromagnet with one or more solenoidal coils wrapped over one or more ferromagnetic bars, the energizing of the said second electromagnet induces a certain direction magnetic field the interaction of which with that of the pieces of permanent magnets causes the revolving arm to rotate around its pivot; an electronic electrical control unit forming an integral part of the device effects, when successfully commanded, the coordinated energizing of the first and second electromagnets together with the concomitant reversal of polarity of the electric current energizing the second electromagnet and thus causes the bolt/bolts to move either from a retracted unlocking position into a protruding locking one and be blocked therein or vice versa.

2 An electromechanical security device as described in Claim 1 wherein the commanding of the control unit can be effected by one or more of the following means: code-operated remote control circuitry, safety key electrical switch, keypad, biometric means of control, coded electronic key or any other similar means.

3 An electromechanical security device as described in Claim 1 and Claim 2 wherein the said revolving arm can take any geometrical form and can be pivoted in the casing of the said device by any manner and at any point thereof.

4 An electromechanical security device as described in Claim 1-3 wherein two or more pieces of permanent magnet are either juxtaposed or diametrically opposed.

5 An electromechanical security device as described in Claim 1- 4 wherein the geometrical construction of said bolt/bolts can be varied in order to effect the desired locking or blocking effect.

6 An electromechanical security device according to Claims 1-5 wherein blocking the movement of either the said bolt or the revolving arm can be effected by varying means of blocking including pins and bars and using one or more of the said first electromagnets.

7 An electromechanical security device according to Claims 1-6 wherein one or more solenoidal coils of the said second electromagnet are wrapped around one or more ferromagnetic bars juxtaposed or diametrically opposed; the solenoidal coils can be connected together in parallel or series, the ferromagnetic bars can be either individual units or linked together at one end by a ferromagnetic plate whether forming a continuation of such bars or separate from them.

8 An electromechanical security device as claimed in Claim 1-7 wherein the electonic control unit can either be placed inside the casing of the said device or outside it if the security conditions permit.

9 An electromechanical security device as claimed in Claim 1-8 wherein the command means can be incorporated in the casing of the device as may be the case when using a safety key electrical switch.

10 An electromechanical security device substantially as hereinbefore described with reference to Figures 1-9 of the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9415170.1

Relevant Technical Fields

(i) UK Cl (Ed.M) E2A (AMXD, AMXF, AMXT, AMXX)

(ii) Int Cl (Ed.5) E05B (47/02)

Search Examiner
MR P SILVIE

Date of completion of Search
27 SEPTEMBER 1994

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASES: WPI

Documents considered relevant following a search in respect of Claims :-
1 TO 9

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

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